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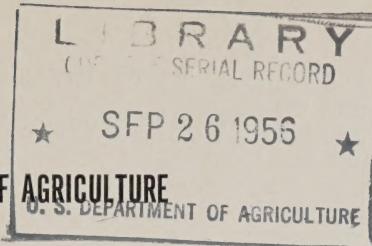
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## Douglas-Fir Beetle

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The Douglas-fir beetle (*Dendroctonus pseudotsugae* Hopk.) is a destructive insect enemy of Douglas-fir, the most important lumber tree of western North America. The beetle is found throughout the range of the host tree, in the Rocky Mountain region from northern Mexico into Canada and in the Pacific Coast region from central California northward through Oregon and Washington to Vancouver Island.

This small beetle is present in Douglas-fir forests at all times, normally killing scattered trees and small groups. Tree killing of this kind often goes unnoticed, but regionally is a large economic loss. At times the Douglas-fir beetle throws off the controlling effects of its natural enemies and becomes epidemic, killing much of the Douglas-fir over extensive areas in a few years.

Examples of widespread destruction by the beetle are the infestation in western Oregon and Washington which killed more than a billion board-feet of prime timber in 1951, and the outbreak in the northern Rockies which killed more than 400 million feet in 1952. Value of the standing trees in these instances was conservatively estimated at 20.1 and 2.1 million dollars, respectively; manufactured

into wood products, the value of the wood would be many times this amount. The outbreaks in these two areas continued to kill trees at nearly this same rate for several years. Other Douglas-fir forests in the West have suffered similarly severe killing by the beetle.

Epidemics of the Douglas-fir beetle usually develop from some abnormal disturbance in the forest. Although the beetle kills apparently healthy trees, it prefers to attack windfalls, fire-scorched trees, logging slash, and trees weakened by defoliation. Where such favorable breeding places are abundant, the beetle population often builds up tremendously and spreads to adjacent green timber.

### Evidence of Attack

The first sign that a Douglas-fir is being attacked is the red boring dust in bark crevices or on the ground around the tree. Because wind and rain soon destroy or lessen this evidence and because attacks are sometimes high above ground level, each tree must be carefully examined to determine whether the beetles are at work.

Several months after the tree is attacked its foliage becomes discolored (fig. 1, A). First the needles turn yellow, then sorrel, and finally a dark reddish brown. The time of

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year this evidence of tree killing shows up varies according to region, elevation, and seasonal weather. In the northern Rocky Mountains, trees attacked in May or June show little discoloration of foliage even in late fall. In Pacific Coast forests, however, trees attacked in the spring usually start fading by August, and by October a large percentage of them appear as "red tops." Because of this variation in the time attacked trees take to turn color, it is usually necessary to examine the trunks of trees for boring dust in order to determine the extent and severity of an infestation.

### **Appearance of the Insect**

The life stages of the beetle are illustrated in figure 1, *B* to *E*. Mature Douglas-fir beetles are stout, cylindrical, reddish to blackish brown insects about one-fourth inch in length. Their eggs are white and small, being about one-twenty-fifth of an inch in length. They hatch into small, white legless grubs, or larvae, with light brown heads. Mature larvae transform to adult beetles by passing through an inactive pupal stage. During this transformation they are the same size as adult beetles.

### **Method of Attack and Habits**

The Douglas-fir beetle, like many species of bark beetles, has a distinctive work pattern that ensures positive identification (fig. 1, *F* and *G*). The female beetles bore through the bark and excavate unbranched tunnels between the bark and wood, and more or less parallel to the grain of the wood. These egg galleries are about one-fourth inch wide and average from 5 to 12 inches long, and are packed solid with boring dust, except where the beetles are actively working. The females lay eggs along the sides of the galleries as construction progresses. The eggs hatch in a week to 10 days and the newly

hatched larvae mine out at right angles to the egg gallery between the bark and wood. These feeding tunnels increase in width as the larvae grow. During the final stages of larval growth, the ends of many feeding tunnels and the pupal cells in which the larvae transform to adult beetles are concealed within the inner bark. Trees are killed by the girdling effects of the egg galleries and larval feeding tunnels. Death is usually hastened by the action of various fungi which are introduced into the trees by attacking beetles and clog the sap-conducting systems.

Attacks of the Douglas-fir beetle are usually most abundant and aggressive about halfway up the tree. They usually extend higher in the tree, however, to a point where it is only 8 to 10 inches in diameter. Oftentimes the lower 10 to 15 feet or more of thick-barked trees either escapes attack entirely the first year or is unsuccessfully attacked. When this occurs, the uninfested base is usually attacked the following year.

The Douglas-fir beetle usually has one generation per year. Possibly more than one may develop in the southern portions of its range, where seasons are warmer and longer. Broods of Douglas-fir beetles remain in the tree and overwinter as mature larvae and adult beetles. Depending on variations in seasonal climates, the overwintering adults may emerge and attack trees any time from April to early June, while the overwintering larvae complete their development and emerge to make their attacks in July and August of the same year. The adults that make their first attacks from April to June re-emerge some 40 days later and make a second and last attack. The broods of beetles that originate from these different periods of attack mature and emerge approximately 1 year later. Consequently broods are found in all stages of development throughout the year.

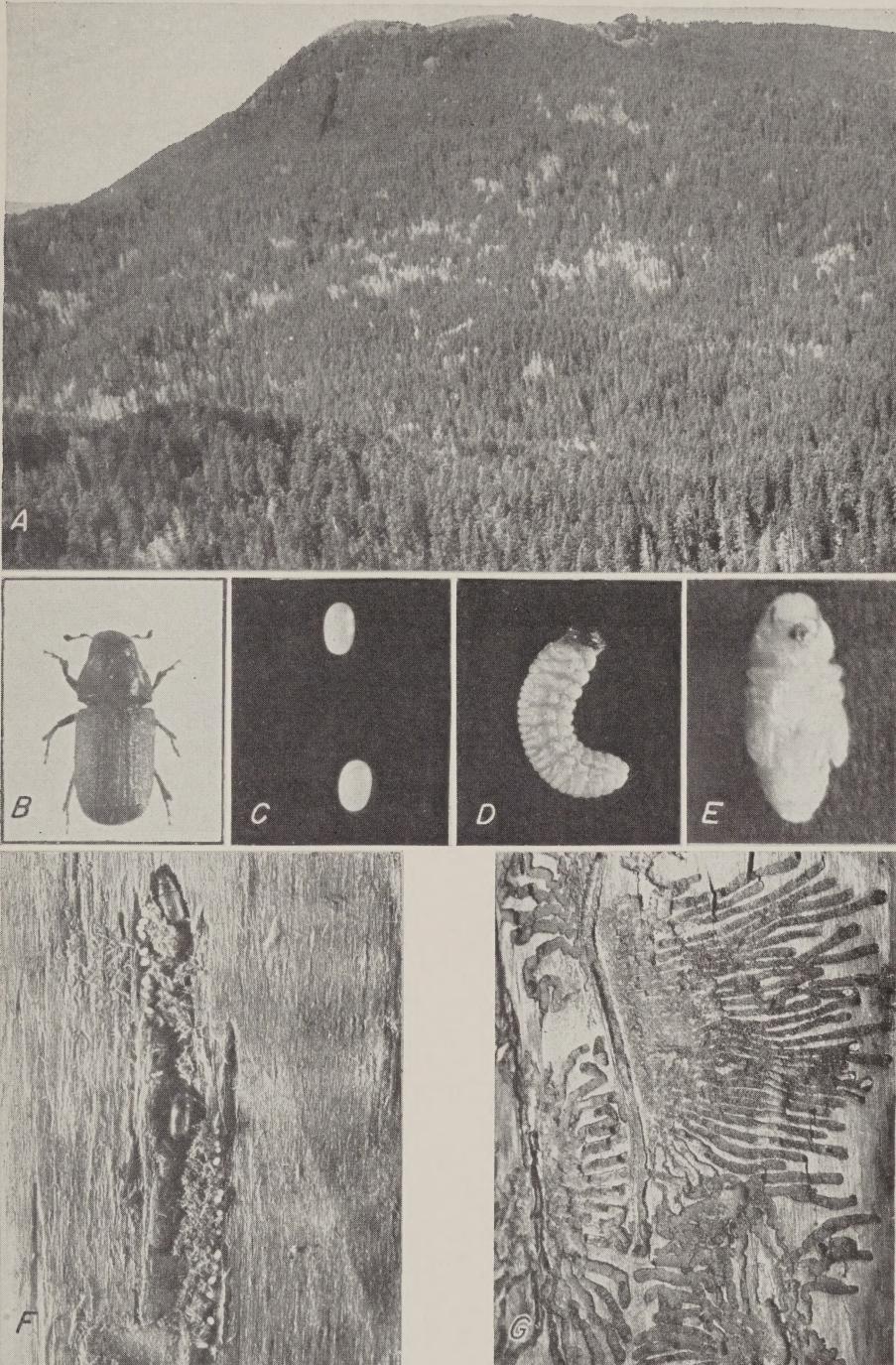


Figure 1.—Douglas-fir beetle: A, Attacked trees become evident as their foliage turns color; B, adult beetle; C, egg; D, legless larva; E, pupa; F, females preparing egg galleries; G, larvae feeding tunnels at right angles to egg galleries.

## Control

Natural control factors tend to hold this destructive bark beetle in check. These factors include climate, bacterial and fungus diseases, a number of parasitic and predaceous insects, and insectivorous birds. Although the beneficial effects of these factors can be recognized and sometimes measured, to direct and utilize them is generally beyond man's ability.

Direct control of the Douglas-fir beetle is difficult and the methods used vary by regions. In Rocky Mountain forests, the recommended method has been to fell the infested trees and then cut them into logs which can be piled and burned. When the trees are too large to handle readily they are felled, the bark peeled and piled along the sides, and then burned. These methods are expensive and are not considered practicable in Pacific Coast forests where trees are generally much larger. The recommended practice here, and recently to some extent in the Rockies, is to remove the infested trees by logging before new broods of beetles can emerge.

Lethal sprays of chemicals that penetrate the bark of infested trees and kill the insects beneath are promising. This method of treatment is expected to be less expensive, more effective, and far less dangerous than the fell-and-burn method.

Preventive control through proper management of Douglas-fir forests offers the best method of minimizing damage by the Douglas-fir beetle. Healthy, vigorous trees are less subject to attack than weak or damaged ones. Prompt salvage or cleanup of windthrown trees, trees scorched or killed by fire, and logging slash will accomplish a twofold objective. The salvage will utilize commercially valuable trees that otherwise would be wasted, and it will remove from the forest material favorable to the development of destructive outbreaks.

## References

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